NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WASTE STORAGE FACILITY

(No.)

CODE 313

DEFINITION

A waste storage impoundment made by constructing an embankment and/or excavating a pit or dugout, or by fabricating a structure.

PURPOSE

To temporarily store wastes such as manure, wastewater, and contaminated runoff as a storage function component of an agricultural waste management system.

This standard establishes the minimum acceptable requirements for planning, designing, constructing, and operating and maintaining waste storage facilities. Storage tanks are used for liquid and slurry wastes and may be open or covered; within or outside an enclosed housing; or beneath slotted floors. This standard also applies to the structural component of composting and stacking facilities. Stacking facilities are used for wastes that behave as a solid.

This standard does not apply to, "Waste Treatment Lagoons".

CONDITIONS WHERE PRACTICE APPLIES

- where the storage facility is a component of a planned agricultural waste management system.
- where temporary storage is needed for organic wastes generated by agricultural production or processing.
- where the storage facility can be constructed, operated and maintained without polluting air or water resources.
- where site conditions are suitable for construction of the facility.
- to facilities utilizing embankments with an effective height of 35 feet or less where damage resulting from failure would be limited to damage of farm buildings, agricultural land, or township and country roads.
- to fabricated structures including tanks, stacking facilities, and appurtenances.

CRITERIA

General Criteria for All Waste Storage Facilities.

Laws and regulations. Waste storage facilities must be planned, designed, and constructed to meet all federal, state, and local laws and regulations. The owner or operator must be responsible for securing necessary permits where required. Any storage pond with a discharge may be required to have a permit. *This standard does not cover installations with planned discharges.*

The Natural Resources Conservation Service will also assist the landowner/ operator in preparing a notification to the Department of Environmental Quality (DEQ) informing them of the installation.

Location. To minimize the potential for contamination of streams, waste storage facilities should be located outside of floodplains. However, if site restrictions require location within a floodplain, they shall be protected from inundation or damage from a 25-year flood event, or larger if required by laws, rules, and regulations. Waste storage facilities shall be located so the potential impacts from breach of embankment, accidental release, and liner failure are minimized; and separation distances are such that prevailing winds and landscape elements such as building arrangement, landforms, and vegetation minimize odors and protect aesthetic values. *Storage facilities will be located a minimum distance of 10 feet from a property line and as far as possible*

from a neighboring dwelling in the direction of prevailing winds and 100 feet from a water well.

Storage period. The storage period is the maximum length of time anticipated between emptying events. The minimum storage period for the accumulation of solids shall be one (1) year. Solids must be removed at least one time during this period. The minimum storage period for the accumulation of liquids shall be ninety (90) days. The liquids must be removed at least once during the period for liquid accumulation. The minimum period for a dry stacking facility shall be 180 days The pond level shall be maintained below the elevation dedicated for the 25-year 24-hour storm storage by frequent land application as climatic, plant and soil conditions warrant.

Waste Utilization Waste removed from the facility shall be utilized in accordance with NRCS Conservation Practice Standards, "Nutrient Management", Code 590, or "Waste Utilization", Code 633. Flow concentrations, ponding, and runoff from the land shall not be permitted.

Design storage volume. The design storage volume, shall consist of the total of the following as appropriate:

(a) Manure, wastewater, and other wastes accumulated during the storage period;

(b) Depth of normal precipitation on the storage facility area (inside the top of the levee for a storage pond) less evaporation from the surface area, at the required volume level, during the storage period plus any runoff from contributing drainage areas during the storage period;

(c) Depth of the 25-year, 24-hour storm precipitation on the storage facility area (inside the top of the levee for a storage pond) and storm event runoff from contributing drainage areas;

(d) Residual solids after liquids have been removed. A minimum of 6 inches shall be provided;

(e) Additional storage as may be required to meet management goals or regulatory requirements.

Size. The volume of the structure shall be large enough to store accumulated waste, bedding, wash water and needed dilution water for the maximum period during which such wastes cannot be processed for energy or be applied to the land because of operational restrictions, weather, or crops. Data in Chapter 4 of the Agricultural Waste Management Field Handbook (AWMFH) can be used in determining the quantity of waste production. Provisions should be made to insure that outside runoff does not flow into the structure. If suitable provisions cannot be made, however, the anticipated volume of runoff likely to enter the structure must be included in the required volume.

Inlet. Inlets shall be of any permanent type designed to resist corrosion, plugging, freeze damage and ultraviolet ray deterioration while incorporating erosion protection as necessary.

When pipe is used, it will meet the quality requirements given under **Pipe, below,** and have a minimum diameter of 8 inches and a minimum slope of 1 percent, except that a minimum diameter of 4 inches may be used for milking center liquid waste. A water-sealed trap and vent or a similar device shall be provided on pipelines from enclosed buildings that discharge into enclosed settling tanks or beneath a storage pond surface.

Pipe. Smooth steel pipe or plastic pipe may be used for the inlet or transfer pipe. Smooth steel pipe may be new or good quality used pipe with a minimum wall thickness of ¼ inch. For plastic pipe to have adequate crushing strength it shall have the equivalent strength of an 80 PSI rated (SDR-51) pipe for depth of fill over the pipe not to exceed 10 feet. Plastic pipe must be PVC pipe meeting the requirements of the American Society for the Testing of Material (ASTM), specification D-2241 or D-1785. All pipe joints shall be made watertight by the use of watertight couplings or by welding. Cantilever lengths shall not exceed 5 feet and the pipe shall be well secured to prevent flotation.

Emptying Component. Provision shall be made for periodic removal of accumulated solids to preserve storage capacity. It may be a facility such as a gate, pipe, dock, wet well, pumping platform, retaining wall, or ramp. The anticipated method for emptying must be considered in planning. Features to protect against erosion, tampering, and accidental release shall be incorporated as necessary.

Safety. Design shall include appropriate safety features to minimize the hazards of the facility. Ramps used to empty liquids shall have a slope of 4 horizontal to 1 vertical or flatter. Those used to empty slurry, semi-solid, or solid waste shall have a slope of 10 horizontal to 1 vertical or flatter, unless special traction surfaces are provided. Warning

signs, fences, ladders, ropes, bars, rails, and other devices shall be provided, as appropriate, to ensure the safety of humans and livestock. Ventilation and warning signs must be provided for covered waste holding structures, as necessary, to prevent explosion, poisoning, or asphyxiation. Ponds and uncovered fabricated structures for liquid or slurry waste with walls less than 5 feet above ground surface shall be fenced and warning signs posted to prevent children and others from using them for other than their intended purpose. *A "WARNING" sign (90 in^2 minimum) shall be placed on each straight section of fencing, not to exceed a spacing of 300 feet.* Fencing shall meet the requirements of NRCS Conservation Practice Standard, "Fence", Code 382, with safety as the objective. The fence shall be located so that maintenance and clean-out equipment will have access to the facility.

Adequate maneuvering space shall be provided for operating loading and unloading equipment. Push-offs must be structurally sound and must be provided with railings, safety bars, or other devices to prevent humans, animals and equipment from falling into the facility.

Erosion protection. Embankments and disturbed areas surrounding the facility shall be vegetated or otherwise stabilized to control erosion. This includes the inside slope of a storage pond. Refer to NRCS Conservation Practice Standard "Critical Area Planting", Code 342.

Additional Criteria for Waste Storage Ponds.

General. Storage ponds resulting from both excavation and embankment are classified as "Embankment Storage Pond" when the design depth of liquid against the embankment is 3 feet or more. When the design depth of liquid against the embankment is between 0 and 3 feet the impondment may be designed as an embankment or an excavated pond. Slopes of the excavated portion and the embankment portion of a storage pond shall be continuous, with no breaks in grade.

Location. The outside toe of the levee or embankment will be *a minimum distance of 10 feet from a property line and as far as possible from a neighboring dwelling in the direction of prevailing winds. The maximum operating waterline that is produced by containing the design storage volume will be a minimum distance of 100 feet from a water well.*

Soil and Foundation. The pond shall be located in soils with an acceptable permeability that meets all applicable regulations, or the pond shall be lined. *A minimum of 2 soil logs, to a depth of at least 2 feet below the planned bottom of the storage pond, shall be taken at the location of the storage pond.* Should the geologic investigation indicate the need for a liner, information and guidance can be found in the (AWMFH), Appendix 10D "Geotechnical, Design, and Construction Guidelines". Liners shall meet or exceed the criteria in NRCS Conservation Practice Standard, "Pond Sealing or Lining", Code 521.

The pond shall have a bottom elevation that is a minimum of 2 feet above the seasonal high water table unless features of special design are incorporated that address buoyant forces, pond seepage rate and non-encroachment of the water table by contaminants. The water table may be lowered by use of perimeter drains, if feasible, to meet this requirement.

Excavations. Unless supported by a soil investigation, *all excavated side slopes shall be no steeper than 2 horizontal to 1 vertical. However, if a compacted clay liner is to be used to control seepage, no slope shall be steeper than 3 horizontal to 1 vertical.*

Operating Level. The maximum operating level for waste storage ponds shall be the pond level that provides for the design storage volume less the volume contribution of precipitation and runoff from the 25-year, 24-hour storm event plus the volume allowance for residual solids after liquids have been removed. A permanent marker or recorder shall be installed at this maximum operating level to indicate when drawdown should begin. The marker or recorder shall be referenced and explained in the Operation & Maintenance (O&M) Plan.

Also the maximum water level in the storage pond shall be a minimum of 1-foot below the lowest elevation of the holding slab or confinement area draining into the storage pond if the area is drained by gravity flow.

Outlet. No outlet shall automatically release storage from the required storage volume. Manually operated outlets shall be of permanent type designed to resist corrosion and plugging.

Features to protect against erosion, liner damage, tampering, and accidental release shall be incorporated as necessary.

Emergency Spillway *An emergency spillway which will have the capacity to safely carry the peak discharge from a 25 year 24 hour storm applied to the entire drainage area, including the pond surface, shall be provided to protect the facility from overtopping; and be so located as not to discharge directly onto an adjacent property or water body.* The spillway crest shall be placed at the elevation of the water surface produced by containing the design storage volume within the facility. The elevation of the water surface, when the spillway is flowing at design capacity will not cause flooding of any buildings (milking center, etc.). The spillway shall have a minimum bottom width of 10 feet and a 3 horizontal to 1 vertical side slopes.

Accumulated Solids Removal. Removal of solids must be planned for, particularly in determining the configuration of a pond and type of seal, if one is needed. For ponds built to store wastewater, an entrance ramp having a slope of 4:1 or flatter may be provided. For those built to store slurry or solid waste, a pumping platform or ramp with a slope of 10:1 or flatter may be provided. Steeper slopes may be used if special traction surfaces are provided. Features to protect against erosion, liner damage, tampering, and accidental release shall be incorporated as necessary.

Runoff from Outside. If an embankment is not used, a levee shall be constructed around the entire periphery of the storage pond to prevent entrance of any outside runoff. It shall have a minimum 1-foot settled height above the adjacent normal ground with a minimum top width of 8 feet and side slopes of 3 horizontal to 1 vertical, or flatter. The top should slope away from the storage pond. The levee shall be constructed adjacent to the storage pond with the slope toe blending with the top of the slope of the storage pond. If a diversion is used to divert water it shall be design and installed according to NRCS Conservation Practice Standard, "Diversions", Code 362.

Embankments. *The minimum elevation of the top of the settled embankment shall be 1-foot above the crest of the emergency spillway.* This height shall be increased by the amount needed for settlement. This increase shall be not less than 5 percent. Actual allowance for shrinkage (in excess of the minimum) shall be determined for the individual site, based on soil type, moisture condition, type equipment used, contractor, and experience in the area. The minimum allowable settlement shall be as shown in Table 2.

Table 2- Minimum Allowable Settlement

Construction Equipment	Allowable Settlement in percent
Bulldozer, & Bulldozer & Dragline Combinations [1]	10
Carryall & Scrapers	5
[1]Drageline construction alone for embankments is not permissible. The use of draglines is permissible where the embankment is compacted in layers of 9 inches or less in thickness by bulldozers, scrapers or similar equipment to obtain the desired compaction of the embankment.	

The combined side slopes of the settled embankment shall not be less than 5 horizontal to 1 vertical, and neither slope shall be steeper than 2 horizontal to 1 vertical.
The minimum top widths shall be as shown in Table 3.

Table 3- Minimum Top Widths

Total Embankment Height, ft.	Top Width, ft.
15 or less	8
15 – 20	10
20 – 25	12
25 – 30	14
30 – 35	15

A cutoff of relatively impervious material shall be provided under an embankment except in those cases where a layer of such material exists at the surface of the foundation. The layer of impervious material shall be thick enough to prevent seepage under the embankment. If required, the cutoff shall extend along the centerline of the embankment and its abutments as required, and be deep enough to extend into a relatively impervious layer. The cutoff trench shall have a bottom width adequate to accommodate the equipment used for excavation, backfill, and compaction operations and have side slopes not steeper than 2 horizontal to 1 vertical.

Additional Criteria for Fabricated Structures.

Foundation. The foundations of fabricated waste storage structures shall be proportioned to safely support all superimposed loads without excessive movement or settlement.

Where a non-uniform foundation cannot be avoided or applied loads may create highly variable foundation loads; settlement should be calculated from site-specific soil test data. Index tests of site soil may allow correlation with similar soils for which test data is available. If no test data is available, presumptive bearing strength values for assessing actual bearing pressures may be obtained from Table 4 or another nationally recognized building code. In using presumptive bearing values, adequate detailing and articulation shall be provided to avoid distressing movements in the structure.

Table 4 - Presumptive Allowable Bearing Stress Values[1]

Foundation Description	Allowable Stress
Crystalline Bedrock	12000 psf
Sedimentary Rock	6000 psf
Sandy Gravel or Gravel	5000 psf
Sand, Silty Sand, Clayey Sand, Silty Gravel, Clayey Gravel	3000 psf
Clay, Sandy Clay, Silty Clay, Clayey Silt	2000 psf

[1] Basic Building Code, 12th Edition, 1993, Building Officials and Code Administrators, Inc. (BOCA)

Liquid tightness. Applications such as tanks, that require liquid tightness shall be designed and constructed in accordance with standard engineering and industry practice appropriate for the construction materials used to achieve this objective.

Structural loading. Waste storage structures shall be designed to withstand all anticipated loads including internal and external loads, hydrostatic uplift pressure, concentrated surface and impact loads, water pressure due to seasonal high water table, and frost or ice pressure and load combinations in compliance with this standard and applicable local building codes.

The lateral earth pressures should be calculated from soil strength values determined from the results of appropriate soil tests. Lateral earth pressures can be calculated using the procedures in NRCS Technical Release (TR)-74. If soil strength tests are not available, the presumptive lateral earth pressure values indicated in Table 5 shall be used.

Lateral earth pressures based upon equivalent fluid assumptions shall be assigned according to the following conditions:

- **Rigid frame or restrained wall.** Use the values shown in Table 5 under the column "Frame tanks," which gives pressures comparable to the at-rest condition.
- **Flexible or yielding walls.** Use the values shown in Table 5 under the column "Free-standing walls," which gives pressures comparable to the active condition. Walls in this category are designed on the basis of gravity for stability or are designed as a cantilever having a base wall thickness to height of backfill ratio not more than 0.085.

Internal lateral pressure used for design shall be 65 lb/ft^2 where the stored waste is not protected from precipitation. A value of 60 lb/ft^2 may be used where the stored waste is protected from precipitation and will not become saturated. Lesser values may be used if supported by measurement of actual pressures of the waste to be stored. If heavy equipment will be operated near the wall, an additional two feet of soil surcharge shall be considered in the wall analysis.

Tank covers shall be designed to withstand both dead and live loads. The live load values for covers contained in American Society of Agricultural Engineers (ASAE) EP378.3, "Floor and Suspended Loads on Agricultural Structures Due to Use", and in ASAE EP 393.2, "Manure Storage", shall be the minimum used. The actual axle load for tank wagons having more than a 2,000-gallon capacity shall be used.

If the facility is to have a roof, snow and wind loads shall be as specified in ASAE EP288.5, "Agricultural Building Snow and Wind Loads". If the facility is to serve as part of a foundation or support for a building, the total load shall be considered in the structural design.

Structural design. The structural design shall consider all items that will influence the

performance of the structure, including loading assumptions, material properties and construction quality. Design assumptions and construction requirements shall be indicated on standard plans.

Tanks may be designed with or without covers. Covers, beams, or braces that are integral to structural performance must be indicated on the construction drawings. The openings in covered tanks shall be designed to accommodate equipment for loading, agitating, and emptying. These openings shall be equipped with grills or secure covers for safety and for odor and vector control.

All structures shall be underlain by free draining material or shall have a footing located below the anticipated frost depth. Fabricated structures shall be designed according to the criteria in the following latest references as appropriate:

- Steel: "Manual of Steel Construction", American Institute of Steel Construction;
- Timber: "National Design Specifications for Wood Construction", American Forest and Paper Association;
- Concrete: "Building Code Requirements for Reinforced Concrete, ACI 318", American Concrete Institute;
- Masonry: "Building Code Requirements for Masonry Structures, ACI 530", American Concrete Institute;
- Flexible Membrane: Flexible membranes shall meet or exceed the requirements of flexible membrane linings specified in NRCS Conservation Practice Standard 521-A, "Pond Sealing or Lining, Flexible Membrane";
- Coatings: Coatings shall be approved in accordance with procedures in the National Engineering Manual (NEM). 210-512.20 to 512.23;
- Glass Fiber Reinforced Plastic/Resins and Glass Fused Steel: Products shall be approved in accordance with procedures in NEM 210-512.20 to 512.23.

TABLE 5 - LATERAL EARTH PRESSURE VALUES

Soil		Equivalent fluid pressure (lb/ft^2/ft of depth)			
		Above seasonal high water table[2]		Below seasonal high water table[3]	
Description[4]	Unified Classification[4]	Free-standing walls	Frame tanks	Free-standing Walls	Frame tanks
Clean gravel, sand or sand-gravel mixtures (maximum 5% fines)[5]	GP, GW, SP, SW	30	50	80	90
Gravel, sand, silt and clay mixtures (less than 50% fines) Coarse sands with silt and and/or clay (less than 50% fines)	All gravel sand dual symbol classifications and GM, GC, SC, SM, SC-SM	35	60	80	100
Low-plasticity silts and clays with some sand and/or gravel (50% or more fines) Fine sands with silt and/or clay (less than 50% fines)	CL, ML, CL-ML, SC, SM, SC-SM	45	75	90	105
Low to medium plasticity silts and clays with little sand and/or gravel (50% or more fines)	CL, ML, CL-ML	65	85	95	110
High plasticity silts and clays (liquid limit more than 50)[6]	CH, MH	-	-	-	-

[1] For lightly compacted soils (85% to 90% maximum standard density.) Includes compaction by use of typical farm equipment
[2] Also below seasonal high water table if adequate drainage is provided.
[3] Includes hydrostatic pressure.
[4] All definitions and procedures in accordance with ASTM D 2488 and D 653.
[5] Generally, only washed materials are in this category
[6] Not recommended. Requires special design if used.

Slabs on grade. Slab design shall consider the required performance and the critical applied loads along with both the subgrade material and material resistance of the concrete slab. Where applied point loads are minimal and liquid-tightness is not required, such as barnyard and feedlot slabs subject only to precipitation, and the subgrade is uniform and dense, the minimum slab thickness shall be 4 inches, with a maximum joint spacing of 10 feet. Joint spacing can be increased if steel reinforcing is added based on subgrade drag theory.

For applications where liquid-tightness is required such as floor slabs of storage tanks, the minimum thickness for uniform foundations shall be 5 inches and shall contain distributed reinforcing steel. The required area of such reinforcing steel shall be based on subgrade drag theory as discussed in industry guidelines such as American Concrete Institute, ACI 360, "Design of Slabs-on-Grade".

When heavy equipment loads are to be resisted and/or where a non-uniform foundation cannot be avoided, an appropriate design procedure incorporating a subgrade resistance parameter(s) such as ACI 360 shall be used.

Additional Criteria for Stacking Facilities.

General. This criterion pertains to permanent structural type stacking facilities. For temporary stacking of dry animal waste refer to, Louisiana Interim Conservation Standard, "Waste Field Storage", Code 3.

Stacking facilities may be open or roofed, and are used for wastes that behave primarily as a solid. The anticipated stacking angle of the waste must be considered in determining the wall height.

Solid stacking implies that the waste has a consistency that does not flow, but remains in place even during the wettest time of the storage period. Facilities receiving 100 percent of the waste production with a high moisture content and no provision for liquid separation, shall not be designed as stacking facilities. To prevent spontaneous combustion, poultry litter in a stacking facility should have less than 40 percent moisture and dry litter and moist litter should not be layered. In addition, the height of the litter stack shall not exceed 5 to 7 feet, with litter to wood contact limited to 3 to 5 feet.

Stacking facilities shall be constructed of durable materials such as reinforced concrete, reinforced concrete block, or treated lumber. They shall be designed according to the Standard Building Code or Uniform Building Code, whichever is locally enforced, for agricultural structures with adequate safety factors to prevent failure due to internal or external pressures, including hydrostatic uplift pressures, wind, snow, ice and other dead or live loads and imposed surface loads such as equipment which may be used within, on, or adjacent to the structure. Lumber shall not be used for walls that support moving stacking elevators or similar loads.

Structural design criteria for stacking facilities shall be in accordance with the criteria for the various materials listed in this standard.

Floors shall slope away from the entrance. Suggested grade of the floor is 2 percent (1/4 inch per foot).

Leachate shall be collected and not allowed to runoff. A means of collecting, storing or treating and utilizing the leachate from waste storage structures shall be inlcuded in the overall waste management system design.

Leachate drainage from storage facilities, including rainfall, from the stacking area (especially those without a roof) may be necessary. This is best accomplished by use of a timber wall with the boards installed vertically, leaving 3/4-inch slots between each board. Additional information can be found in Chapter 12, pages 12-36 thru 12-38 of the AWMFH and Chapter 6, pages 6.7 thru 6.10 of the Midwest Planning Services – 18 Livestock Waste Facilities Handbook (MWPS-18). The timber wall drainage section may be included in a concrete or masonry block wall. Design criteria shall be the same as for timber walls.

CONSIDERATIONS

General.

A waste storage facility should be located near the source of waste and as far from neighboring dwellings as practicable. If possible, locate the storage facility where it is not visible from residences and public areas, and prevailing winds will carry odors away from these areas. Waste

storage facilities should be located a minimum of 300 feet from an adjacent property dwelling. Vegetated screens should be considered when the storage facility would be visible from residences or public areas.

The location, layout and design of the facilities should be compatible with the surrounding landscape. Existing landforms and vegetation, along with land shaping and vegetative plantings, should be considered to minimize an adverse impact upon visual resources.

Non-polluted runoff should be excluded from the structure to the fullest extent possible except where its storage is advantageous to the operation of the agricultural waste management system.

Freeboard for waste storage tanks should be considered.

An inlet pipe should extend a minimum of 5 feet past the bottom toe of a storage pond to ensure good distribution. Access should be provided to the pipe for rodding in case of blockage.

To minimize the frequency of solids removal from the storage facility, direct polluted runoff through vegetative filter strips, low-gradient channels, or debris, sediment or settling basins to remove readily settleable solids. A solids trap (settling basin) or a separator may be provided between the waste source and the storage facility. This may be a concrete or earthen structure that can be emptied periodically. A minimum of 30 days storage should be provided. In Louisiana due to the frequency of precipitation events, a minimum of 2 should be planned so that one can be dried and cleaned while the other is functioning. Additional information can be found in Chapter 12, pages 12-36 thru 12-38 of the AWMFH and Chapter 6, pages 6.7 thru 6.10 of the Midwest Planning Services – 18 Livestock Waste Facilities Handbook (MWPS-18).

Equipment should be available for removing waste from the storage structure, processing them for energy, or applying them to the land at locations, times and rates shown in the overall management plan.

Due consideration should be given to environmental concerns, economics, the overall waste management system plan, and safety and health factors.

Development of an emergency action plan should be considered for waste storage facilities where there is a potential for significant impact from a breach of an embankment or accidental release. The plan shall include site-specific provisions for emergency actions that will minimize these impacts.

Considerations for minimizing the potential for and impacts of sudden breach of embankment or accidental release from the required volume.

Features, safeguards, and/or management measures to minimize the risk of failure or accidental release, or to minimize or mitigate impact of this type of failure should be considered when any of the categories listed in Table 6 might be significantly affected.

The following should be considered either singly or in combination to minimize the potential of or the consequences of sudden breach of embankments when one or more of the potential impact categories listed in Table 6 may be significantly affected:

1. Additional freeboard;
2. Storage for wet year rather than normal year precipitation;
3. Reinforced embankment -- such as, additional top width, flattened and/or armored downstream side slopes;
4. Secondary containment;
5. Water level indicators or recorders.

Table 6 - Potential Impact Categories from Breach of Embankment or Accidental Release

1. Surface water bodies -- perennial streams, lakes, wetlands, and estuaries
2. Critical habitat for threatened and endangered species
3. Riparian areas
4. Farmstead, or other areas of habitation
5. Off-farm property
6. Historical and/or archaeological sites or structures that meet the eligibility criteria for listing in the National Register of Historical Places

The following options should be considered to minimize the potential for accidental release from the required volume through gravity outlets when one or more of the potential impact categories listed in Table 6 may be significantly affected:

1. Outlet gate locks or locked gate housing;
2. Secondary containment;
3. Alarm system;
4. Another means of emptying the required volume.

Considerations for minimizing the potential of waste storage pond liner failure.

Sites with categories listed in Table 7 should be avoided unless no reasonable alternative exists. Under those circumstances, consideration should be given to providing an additional measure of safety from pond seepage when any of the potential impact categories listed in Table 7 may be significantly affected.

Table 7 - Potential Impact Categories for Liner Failure

1. Any underlying aquifer is at a shallow depth and not confined
2. The vadose zone is rock
3. The aquifer is a domestic water supply or ecologically vital water supply
4. The site is located in an area of solutionized bedrock such as limestone or gypsum.

Should any of the potential impact categories listed in Table 7 be affected, consideration should be given to the following:

1. A clay liner designed in accordance with procedures of AWMFH Appendix 10D with a thickness and coefficient of permeability so that specific discharge is less than 1×10^{-6} cm/sec.;
2. A flexible membrane liner over a clay liner;
3. A geosynthetic clay liner (GCL) flexible membrane liner;
4. A concrete liner designed in accordance with slabs on grade criteria for fabricated structures requiring water tightness.

Considerations for minimizing the impact of odors.

An anaerobic lagoon instead of a waste storage pond should be considered for sites located in rural areas where odors are a concern. This should be especially considered where odors would affect neighboring farms having enterprises that do not cause odors and/or neighbors who earn a living off-farm. For design of lagoons see NRCS Conservation Practice Standard, "Waste Treatment Lagoon", Code 359.

For sites located near urban areas practices such as the following should be considered to reduce odor emissions:

1. Covering the storage facility with a suitable cover;
2. Using naturally aerated or mechanically aerated lagoons;
3. Using composting in conjunction with a solid waste system rather than a liquid or slurry system;
4. Using a methane digester and capture system.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use. The construction specifications shall be written for site specific conditions, and shall be included in the plans and specifications, and adhered to during construction. For guidance on specifications, see "WASTE STORAGE FACILITY, SPECIFICATION".

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be developed that is consistent with the purposes of the practice, it's intended life, safety requirements, and the criteria for its design.

The plan shall contain the operational requirements for emptying the storage facility. This shall include the requirement that waste shall be removed from storage and utilized at locations, times, rates, and volume in accordance with the overall waste management system plan. In addition, for ponds, the plan shall include an explanation of the permanent marker or recorder installed to indicate the maximum operating level. The plan shall include a strategy for removal and disposition of waste with least environmental damage during the normal storage period to the extent necessary to

insure the pond's safe operation. This strategy shall also include the removal of unusual storm events that may cause the pond to fill to capacity prematurely with subsequent design inflow and usual precipitation prior to the end of the normal storage period.

As a minimum the following will be addressed in the plan:

Floating Material Where feasible keep bedding material, straw, oil and other floating material out of a storage pond.

Maintenance Waste storage structures shall be inspected periodically. Grass shall be kept mowed, and the embankment and edges kept free of weeds, shrubs and trees around a storage pond. Sludge removal shall be in accordance with the design.

Road System An adequate road system shall be planned to provide access to the waste storage facility, appurtenant structures, and other pertinent parts of the system. If needed, an area for turning shall be provided where the fill is also used as a road. Adequate ramps shall be provided.

Waste Storage Pond Levels Whenever the waste storage pond level encroaches into the volume dedicated to store storm runoff, the excess volume shall be removed in a timely manner. This effluent shall not be allowed to enter the waters of the state.